TRANSBOUNDARY GAS GROUP MEETING NOTES

Simon Fraser University
Vancouver, British Columbia
Canada

October 22-23, 2002

Day 1: October 22, 2002

1. Greetings and Introductions.

Facilitator Daniel Millar of Environment Canada welcomed everyone to today's meeting, then led a round of introductions and a review of today's agenda.

2. Review of Notes from April 9-10 TGG Meeting in Wenatchee.

The minutes from the April Transboundary Gas Group meeting were approved as written.

3. Total Dissolved Gas Monitoring and Modeling.

A. Data Quality Criteria for Fixed Monitoring System Update. Dick Cassidy of the Corps of Engineers led this presentation, saying first that he wanted to go over some of the highlights of the data quality criteria presented by Laura Hamilton at the TGG's Wenatchee meeting. This is an important step for the Corps, he said; data quality was one of the parameters specified by NMFS in the 2000 FCRPS Biological Opinion, and if we can meet those criteria, we won't have to install redundant stations at all of our fixed monitoring locations.

The criteria we recommended fell under several main headings, Cassidy explained: laboratory and field calibration protocols, daily data review protocols, protocols for dealing with suspect data, and protocols for assessing the completeness of the data. Cassidy went briefly through the details of the specific measures the Corps is recommending under each of these criteria headings.

Cassidy then provided several examples of how the completeness and quality of the Corps' TDG data is summarized for each of the mainstem water quality fixed monitoring

stations. He noted that it is no small effort for the Corps to implement such unified data quality protocols, because this task has, in the past, been shared by the three Corps districts in the Northwest. It took three years of development and negotiation, he said, but we are now using these protocols in the development of our annual report. This document is important not only to NMFS in evaluating whether the Corps is meeting the 2000 BiOp's reasonable and prudent alternative actions, but to the state water quality agencies in evaluating the Corps' TDG program.

Is the Corps' data available on the web? one participant asked. Yes, Cassidy replied – historic data is available back to 1995, and up to the previous day of interest -- there's about a four-hour lag to download the daily data. And that's in HTML format? the participant asked. Correct, Cassidy replied. Mark Schneider added that this information is available via the Technical Management Team website (http://www.nwd-wc.usace.army.mil/TMT/).

Dana Schmidt asked about the details of how the Corps calibrates its instruments; Cassidy reiterated that each instrument is calibrated in the lab, then in the field. Paul Pickett noted that the Corps' calibration is done without the membranes in place; the membranes are installed in the field. The data quality work that's being done – are you looking at EPA and state QA/QC protocols? Pickett asked. No, Cassidy replied. That might be a good step to take, Pickett noted. A participant added that the Washington Department of Ecology (WDOE) is in the process of compiling a GIS-based list of all of the fixed monitoring sites in the Northwest; it would be helpful if everyone here could review that to ensure that WDOE has their site locations correct, he said.

The group discussed the feasibility of developing a stand-alone document summarizing all of the annual water quality data collected by everyone in the region – U.S. federal agencies, Canadian entities, states, tribes, PUDs and others. Mark Schneider suggested that this might be an appropriate task for a new TGG subcommittee. It would be even better if everyone in the region could be persuaded to adopt these protocols, so that the data collected is as consistent as possible throughout the region, he said.

B. Overview of 2002 Runoff Conditions. Jim Irish of the Bonneville Power Administration (BPA) briefed the TGG on the 2002 water year in the Columbia and Snake River systems. He touched on the following major topic areas:

- What did we know at the start of the water year? (just came off second-the lowest January-July runoff volume in the historic record)
- Precipitation for WY 2002 (October 2001-September 2002)
- Percent of average snowpack for the Columbia above Grand Coulee (graph) – 115% of average
- Percent of average snowpack for the Snake above Ice Harbor (graph) – slightly below-average

- Percent of average snowpack for the Columbia above The Dalles (graph) – slightly above-average
- Mountain snow-water equivalent as of May 1, 2002 (map) – generally below-average in the southern part of the basin, generally above-average in the northern part of the basin
- Monthly temperature departure, May 2002 (map) – significantly below-average across the basin, which kept the snowpack in the mountains
- Precipitation grids across the basin in June (maps) – generally above-average, further augmenting snowpacks prior to the start of the runoff
- Daily natural flows at The Dalles, 2002, October 2001-September 2002 minimum and maximum daily values, 1969-2001, 60-year median, WY'02 observed. In general, the freshet started late and came off quickly.
- Summary: The month of May had near-normal precipitation, but persistent cool temperatures during the month caused this precipitation to be in the form of snow in many areas, continuing to add to the already-above-normal snowpack across the northern half of the basin. The cool May also helped retain the snow that was already there.
- Even with the slightly-below-normal precipitation for the year falling on dry soil conditions, the distribution (heavily into the snowpack) and the slightly delayed runoff helped to bring in an overall runoff that was only slightly below normal.
- Total 2002 outflow and spill at McNary and Ice Harbor Dams, plus total Mid-Columbia flow, April 1-August 31 (graph).

What are the implications of the kind of water year we saw in 2002 to Grand Coulee operations? one participant asked. The issue at Grand Coulee this year is that the flows from Canada came off later than expected, which meant Grand Coulee had to draft significantly more than usual in order to meet power operations, Dave Zimmer replied.

The group devoted a few minutes of discussion to the issue of the 2002 water year's effects on Grand Coulee operations, from a water quality standpoint. Ultimately, Millar noted that there will be an opportunity to discuss this issue further during the Q & A session at the end of this agenda cluster.

C. U.S. Army Corps of Engineers. Cassidy briefed the TGG on the goals and specific details of the Corps' 2002 water quality monitoring program, which are aimed at meeting the 120% tailwater/115% forebay TDG standard at the next dam downstream. Essentially, he said, our goal is to edge right up to those two waiver levels without exceeding them. He touched on the following major topic areas:

- Monthly average % TDG for 12 highest hours at Corps projects during the 2002 spill season, number of exceedances at Corps projects during the 2002 spill season (graphs) – in general, while there were numerous exceedances (267 in all), particularly below Bonneville Dam.
- The average number of TDG exceedances during the 2002 spill season, April 8-August 30 2002.

The group discussed some of the reasons for the large number of TDG exceedances during the 2002 spill season, including down time on the California intertie and the fact that numerous new flow deflectors were in place for the first time this year, which meant that, at many locations, the Corps was essentially operating a new system, with associated trial-and-error in setting operations to reach, but not exceed, the TDG waiver limits. Also, said Irish, during the latter part of the season, fires were burning below power lines in Oregon and California, which caused some instances of lines sagging and being derated.

D. Chelan County PUD. Keith Truscott led this presentation. He began with a description of Chelan PUD's operating and geographic scope, then moved on to a graph showing streamflow, forebay and tailwater TDG levels at Rocky Reach Dam during the period April 1-August 31, 2002. He noted that, at this project, the upstream TDG influence is critical; pretty much every time you see an exceedance in Rocky Reach's tailwater TDG, you see TDG levels in excess of the state standard coming into the project's forebay monitoring station.

Next, Truscott provided a graph showing Rocky Reach's instances of daily exceedance of the forebay and/or tailrace TDG standard in 2002; as you can see from this graph, he said, there were times when incoming TDG levels to the project exceeded 130%, and there was often a degassing effect, particularly when TDG levels were at their highest, at the project.

Truscott moved on to 2002 streamflow and TDG data for Rock Island Dam. He noted that there were a couple of instances when TDG levels in the tailrace were significantly higher than they should have been, based on the historic data at the project. That was a head-scratcher, he said; the bottom line is that we instituted a number of operational changes at the project to reduce TDG production at Rock Island – changes to the spill pattern, increased monitoring frequency etc. These changes did produce the desired result, in terms of reducing TDG levels below Rock Island; when we began re-introducing normal operations one by one, we found that the change in spill bays was the operation that reduced TDG production at Rock Island, Truscott said.

E. CRIEMP Program, Brilliant Expansion Program Update. Dana Schmidt briefed the group on results from the 2002 CRIEMP monitoring program. Schmidt noted that much of this information comes from the draft report generated by CRIEMP, titled "Fisheries Resource Information and TGP Risk Assessment for the Canadian Portion of the Lower Columbia River Basin." The topic of Schmidt's presentation was "Total Gas Pressure and Fish Distribution Investigations in the Canadian Portion of the Columbia River Basin." He worked from a series of overheads, touching on the following major topic areas:

- The CRIEMP Fish and TGP Study (methodology)
- The geographic scope of the CRIEMP study
- The locations of the monitoring stations providing data for the CRIEMP study
- The mass-balance equations and coefficients used in the study, by location
- Sample TGP model output summaries from simulations, 1991-1999, by location – Brilliant tailrace, Brilliant forebay, Kootenay Canal tailrace, Lower Bonnington tailrace, South Slocan forebay (table)

- TGP consecutive days exceedance probabilities, Brilliant Dam tailrace (graph)
- TGP and fish-risk rating – depth and TGP Level matrix to determine specied TGP risk rating (fish depth vs. TGP level) (table)
- Risk ranking table for selected fish species (example table) – rainbow trout, white sturgeon, bull trout, burbot, mountain whitefish, kokanee, other species, by reach and season of year
- TGP levels under the simulation, days of TGP exceedance, by reach (bar graph)
- Kootenay River TGP – baseline (days of TGP exceedance, by project) (bar graph)
- TGP exceedance on the Pend d'Oreille River – days of TGP exceedance, by reach (bar graph)
- Impacts of HLK and Brilliant expansion on TGP production – days of TGP exceedance, by reach, with and without the Keenleyside power plant and the Brilliant expansion (bar graph)
- Summary: TGP was highest below Lower Bonnington, Keenleyside and Boundary Dams
- TGP has the longest persistence (consecutive days of TGP in excess of guidelines) below Brilliant and Waneta Dams
- Sportfish and listed species have the highest abundance below Brilliant, Keenleyside and Waneta Dams (Mainstem Columbia River)
- All of the reaches with fish and elevated TGP have sufficient depth that fish may avoid TGP by sounding
- Future work should focus on problem areas, including Waneta and Boundary

Swain then moved on to another presentation, "Brilliant Expansion Selected Project Concept TGP Benefits." This presentation focused on the following subjects:

- The Brilliant expansion project is intended to retrofit Brilliant Dam, which is currently a bottleneck on the system. Columbia Power is in the process of committing to installing another power plant at Brilliant, with a hydraulic capacity of 120 aMW+.
- A summary of Brilliant expansion selected project concept (120 aMW) TGP benefits – days of exceedance of TGP standard – 110%, 115%, 120%. With the use of spill bays 7 and 8, and the new power plant in place, we expect that we will actually do better than we would if the dam was not in place -- we expect to see some actual reduction in gas levels passing through the project, at least under some hydraulic conditions, Schmidt said.
- Brilliant expansion – selected concept project – days of exceedance of 110% TGP, pre project, baseline concept, selected project concept at the border, at Birchbank and in the Brilliant tailrace (bar graph).

Schmidt noted that the selected project alternative is expected to result in a 93% reduction in the number of days of exceedance in the Brilliant tailrace. He added that another letter of support for the Brilliant expansion project from the Transboundary Gas Group would be helpful, at this point. It was agreed to discuss this issue further later in today's meeting.

F. Douglas County PUD. Rick Klinge led this presentation. He began with a report on monitoring at Wells Dam in 2002, including the frequency with which data was downloaded and instruments were calibrated (typically every 30 days, unless problems are noted). He noted that, this year, for the first time, Douglas PUD added a midwater probe in the Wells Dam tailrace for data comparison with the normal tailwater probe. Klinge also described some of Douglas PUD's QA/QC procedures, as well as some of the data logging and downloading problems Douglas PUD experienced this year.

Klinge noted that there were numerous occasions in June and July 2002 when tailwater TDG levels exceeded the 120% standard below Wells Dam on a 12-hour daily average, despite the fact that forebay TDG levels at Wells never exceeded 120% in 2002. Obviously, tailwater TDG levels were a big problem for us this year – of the 168 days in the season, we had 31 days above 120%, including one day at 136.9% on a 12-hour average, he said, adding that scheduled maintenance outages, which were not adequately coordinated with his office, was partly to blame for this problem. Klinge also provided data on seven-day average flows at Wells through the spill season; the project was passing more than 230 Kcfs during the period when the highest TDG readings were recorded in early July. Klinge said Douglas PUD is investigating potential operational, rather than structural, fixes to avoid this problem in the future.

Were you also hampered by the intertie problem? one participant asked. I think everybody was, Klinge replied.

G. Grant County PUD. No Grant PUD presentation was provided at today's meeting.

H. Seattle City Light. Al Solonsky said Seattle City Light did a study this past spring with Columbia Basin Environmental; the results from that study will be available at the next meeting of the TGG. He reminded the group that Seattle City Light operates Boundary Dam on the Pend Oreille River, and described its physical and operational configuration. He noted that there are some issues that have been identified regarding operations at that project, in particular, the tendency of its turbine units to entrain air during periods of inefficient operation. Solonsky described some of the investigations Seattle City Light has undertaken to reduce TDG problems at this project, which is up for relicensing in 2011.

Moving on, Solonsky touched on:

- TDG levels measured immediately downstream from Boundary Dam, Spring 1998 – various total flow and spill conditions (table).
- The location of the forebay and tailrace fixed monitoring locations relative to the dam (map).

4. 2002 Studies of Rocky Reach, Priest Rapids and Wells Dams.

This presentation was led by Mike Schneider and Joe Carroll. Schneider began with a report titled "Total Dissolved Gas Exchange at Priest Rapids Dam." He noted that this study

was conducted earlier this year; while we're still working up the results, he said, I did want to go through the methodology employed in the study. Schneider touched on the following main topics:

- Introduction and background (the unique physical and operational characteristics of Priest Rapids Dam, past studies)
- Priest Rapids Dam operations and TDG saturation at the forebay and tailwater fixed monitoring stations, June 2002 (graph)
- The objectives of the study (describe the gas exchange process at Priest Rapids Dam under various spill rates, patterns and tailwater elevations; quantify mixing, transport and exchange of TDG from Priest Rapids to the tailwater fixed monitoring site; evaluate the representativeness of the forebay and tailwater fixed monitoring stations)
- The approach used in the study (deploy an array of 20 TDG sensors to evaluate spatial and temporal TDG patterns, quantify TDG characteristics for specific events, monitor spillway discharge under various standard and non-standard spill patterns and discharges, evaluate the effects of various tailwater elevation and powerhouse discharges)
- Site characterization of Priest Rapids Dam with respect to TDG production
- The location of the various sampling arrays used in the 2002 study
- The operations that occurred during the test period (76 Kcfs average spill, 147 Kcfs average total river flow, stilling basin depths ranging from 16 to 32 feet)
- A video showing actual spill at Priest Rapids under a spillway discharge of 73.5 Kcfs
- Videos illustrating spillway and tailrace conditions under various spill patterns
- Results (evaluation of data is still in progress, but the study generated a detailed data set on TDG response under a broad range of flow and spill conditions; it should be possible to evaluate the representativeness of the forebay and tailrace fixed monitoring stations.
- The final report on the 2002 study is due out at the end of 2002.

Next, Schneider moved on to a similar presentation on TDG exchange at Rocky Reach Dam. He touched on the following major topics:

- The physical layout of Rocky Reach Dam
- The introduction and background to the study
- The objectives of the Rocky Reach study (describe the dissolved gas exchange process under a range of spill discharges and patterns, tailwater stages and powerhouse operations, evaluate mixing, transport and exchange of TDG pressures down to the tailwater fixed monitoring station, evaluate the representativeness of the forebay and tailwater FMS)
- The approach used in this study (deploy an array of TDG sensors at various tailwater and forebay locations, evaluate spillway discharge under a variety of spill bay discharges, uniform and standard spill patterns, and powerhouse operations)
- A site characterization of Rocky Reach Dam
- Various photographs illustrating the layout of the dam and the notched end sill below the Rocky Reach stilling basin
- The study design (sampling arrays in various locations above and below the dam, the operating conditions under which the 2002 study was conducted)

- The exact location of the 2002 TDG sampling stations (aerial photographs)
- Instruments used, parameters measured
- Tailwater and project operations at Rocky Reach during the test period (graph)
- Rocky Reach Dam operations during the test (spill discharges in the 10-61 Kcfs range etc.)
- Videos illustrating flows downstream of the dam under a uniform 39.5 Kcfs spill pattern on April 30 and 40 Kcfs-47 Kcfs uniform spill on May 2
- Results (a very complete return of instruments and data, good information quantifying extreme/average TDG response, an evaluation of the representativeness of the FMS, sensitivity to alternative spill patterns and operations, final report due out by the end of 2002).

The group asked a few general questions about the physical layout of the project and the effect of these features on dissolved gas distribution downstream of Rocky Reach.

5. Effects of Environmental Factors on TDG Measurements.

Joe Carroll led this presentation, titled "Effects of Environmental Factors on TDG Measurement and Interpretation." He touched on the following major topic areas:

- Environmental factors (physical processes – mixing, dilution, attenuation, diffusion, natural falls and rapids, wind, tributary inflow mixing and dilution, air/water exchange, temperature, air/barometric pressure; Biological [metabolic] processes – photosynthesis, community respiration)
- The Dalles pool TDG % saturation, transects below John Day Dam (graphs)
- Time history of Kootenai River TDG supersaturation below Libby Dam at the USGS gauging station, June 24-July 9 2002 (graph)
- Time history of Kootenai River TDG supersaturation upstream and downstream of Libby, Montana, June 24-July 9 2002 (graph)
- Conditions at the Kootenai River's China Rapids at a total river flow of 27 Kcfs (photograph)
- Conditions of Kootenai Falls at a total river flow of 32 Kcfs (photograph)
- Average TDG saturation below Libby Dam after 10 hours of constant operation (TDG levels under various spill and total river flow conditions at various locations below the project) (graph)
- Wind effects on TDG exchange
- Lower Columbia River forebay TDG % saturation and average daily wind speed, 1996 (for Bonneville, John Day, The Dalles and McNary), June 15-August 14, 1996 (graph)
- Wind-related TDG response at the Camas/Washougal FMS, May 2001 – TDG level, river flow and wind speed (graph)
- Diel cycles in dissolved oxygen, temperature and atmospheric pressure (a summary of the effects of environmental factors on water quality)
- Lower Snake River-mile 139.7 (confluence of Lower Snake and Clearwater Rivers) TDG % saturation and water temperature, April 17-April 23 (graph)
- Lower Columbia River TDG, DO and temperature, June 13-15, 2001, under a constant 50

Kcfs Bonneville spill (graph)

- Temperature and TDG upstream and downstream of Libby, Montana under total discharge of 40 Kcfs and 15 Kcfs spill – June 24-July 12, 2002 (graph)
- Average TDG pressure vs. distance below Libby Dam during June 27, 2002, spillway flow of 7 Kcfs – TDG readings at various monitoring locations downstream (graph)
- John Day Dam forebay TDG and temperature, July 5-15, 2002 (graph)
- Summary: changes in TDG resulting from naturally-occurring processes downstream of Bonneville Dam (table)

Q & A. The action items I've written down include the development of a document spelling out the protocols for data collection basinwide, said Millar. We talked about that at lunch, said Mark Schneider; it was pointed out that there are several groups doing routine water quality monitoring, generally following quite similar protocols. Our thought was that there should be a document that compiles our collective regional wisdom on TDG, Schneider said. The basic idea is that whatever data is collected be clearly defined, said Schneider. We'll put some thought into that, said Millar.

The second action item I have is that WDOE will provide their protocols for calculating 12-hour average TDG, Millar said. The third is that we need to get a copy of Dana Schmidt's report, he said. Finally, he said, we discussed the possibility of drafting another letter of support for the Brilliant expansion project from the TGG.

6. Structural and Operational Gas Abatement.

I. U.S. Army Corps of Engineers.

A. Chief Joseph Deflectors. In the absence of Marian Valentine, this topic was not addressed at today's meeting.

B. Libby. Kent Easthouse provided a presentation titled "Libby Dam Spill Test Total Dissolved Gas Study." Easthouse noted that this test, conducted this summer, was called for under the 2000 FCRPS Biological Opinion; the goal is to increase the release capacity by up to 10 Kcfs to benefit the recovery of Kootenai River white sturgeon. The test was also part of the VarQ storage/flood control operation, which may increase the risk of spill at Libby. Moving on, Easthouse touched on the following major topic areas:

- The objectives of the test, including the provision of recommendations for future water quality studies and monitoring locations
- The background for the test – no spill at Libby since 1984; TDG concentrations measured during spill in the 1970s exceeded 140%; Libby was under pressure to spill during the high runoff years of 1996 and 1997
- A description of the Libby project and its current configuration
- The physical location of the project (map)
- Various photographs showing the project in operation
- The study design

- The study methodology

Mike Schneider then reported on the water quality data obtained during the 2002 Libby spill study, including:

- A physical description of the Libby project
- The study design (sampling array, operating conditions)
- Water quality sampling instruments used and locations deployed, data logging protocols
- Libby operation during the test period (continuous spill June 25-July 7, 0.6 Kcfs-15 Kcfs; tailwater elevations 51-54 feet)
- Spill and total river flow at Libby, June 24-July 10 (graph)
- Findings: temperature and TDG pressures non-uniform in forebay; thermal stratification, thermally-induced TDG pressure gain in surface layers, near-surface TDG approached 115%
- Forebay temperature profile at the face of Libby Dam, June 25, 2002 (graph)
- Forebay water temperatures at various depths in Lake Kookanusa, June 27-July 11, 2002 (graph)
- Lake Kookanusa and Kootenai River water temperatures near Libby Dam, June 24-July 10, 2002 (graph)
- Forebay TDG pressure profile at the face of Libby Dam, June 25, 2002 (graph)
- Summary: powerhouse releases generally do not change TDG pressures; Libby Dam releases water well below the warmer surface layer
- TDG supersaturation in the forebay and below the powerhouse of Libby Dam, June 24-July 9, 2002 (graph)
- Summary: spillway releases resulted in elevated TDG pressures; TDG saturation increased as an exponential function of spill discharge
- Time history of Kootenai River TDG saturation below the Libby Dam spillway and at the Thompson Bridge, June 24-July 9, 2002 (graph)
- Observed and calculated delta TDG pressure versus total spillway discharge at Libby Dam, Summer 2002 (graphed response curve – the delta pressure flattens out when spill discharge reaches 7 Kcfs)
- Observed and calculated TDG saturation vs. total spillway discharge at Libby Dam, summer 2002 (graphed response curve)
- Lateral distribution of TDG saturation at the tailwater gauging station (bar graph)

Next, Carroll briefed the group on what the study revealed about downstream TDG transfer during the test. His presentation included:

- A physical description of the monitoring sites used in the study
- The lateral gradient of TDG distribution at the USGS gauging station, Fisher and Haul bridges, and upstream and downstream of Libby, Montana and Kootenai Falls, June 24-July 9, 2002 (graphs)
- The effects of Kootenai Falls on TDG saturation levels in the Kootenai River
- Average TDG saturation below Libby Dam after 10 hours of constant operation for various sites up to 32 miles downstream of the project (graph) – Kootenai Falls added up

to 10% TDG saturation

- Kootenai River flow and TDG saturation below Libby Dam, June 24-July 23, 2002 (graph)

Finally, Easthouse touched on the biological monitoring conducted during the test, including results from the net-pen study conducted at various locations below the dam. Easthouse noted that some signs of GBT were found, mostly bubbles in the eyes; there were no signs noted during the first few days of spill. After July 1, all of the fish in the study (rainbow trout and mountain whitefish) showed some signs of GBT. Montana thinks most of the mortalities were as a result of handling, Eastlake said, emphasizing that the number of fish used in the study was very low. All of the fish held in the shallowest pens (1.5 feet) died during the test, while only five of the 34 fish held at a depth of 4.4 feet or greater died. He added that, in general, the caged fish showed more severe signs of GBD than those fish sampled through electrofishing in the river at large.

Easthouse then moved on to conclusions and recommendations from this work; please refer to his presentation for full details.

II. Canadian Projects.

A. Kootenay River Monitoring Results. Schmidt led this presentation; he began with a report titled "Kootenay River TGP Monitoring, Libby Spill 2002." Schmidt said he was pleased to discover, during yesterday's presentations, that his data from the 2002 Libby spill experiment and Joe Carroll's were extremely similar.

We took some point measurements in the Kootenay River near Creston, and found 108%, 112% and 111% TGP on June 20, July 3 and July 16, respectively, Schmidt said. He also displayed a graph titled "Kootenay River 2002 TGP Monitoring During Libby Spill," covering the period June 18 through July 16, charting Libby discharge against percent saturation at Creston Bridge, a mile or two south of the U.S./Canada border. Schmidt also provided a graph showing TGP vs. water temperature during this period.

Schmidt also provided the following conclusions: TGP on the Kootenay River in Canada was likely dissipated by the time it has reached this area; diel temperature and photosynthesis are likely causes of observed daily variation. In response to a question from Solonsky, Carroll noted that TDG levels remain high in the entire 84-mile stretch between Libby and the border – if it's 115% in the Libby tailrace, due to the gassing effects of the falls, it's still going to be 110% by the time it reaches the border, he said. Another participant noted that, in the pre-dam period, there were many natural falls on the Kootenay and Columbia Rivers; natural peak flows and TDG levels during the freshet used to be much higher than they are today. It was suggested that Kootenay Falls might be a good site to study the gassing effects of natural cascades.

Day 2 – October 23, 2002

1. Canadian Projects (Cont'd)

B. Kootenay River Projects. Margaret Trenn said her organization did no water quality monitoring this year at its four Kootenay River power plants, so she has nothing of substance to report.

C. Waneta. John Ritchie provided a presentation titled "Modeling of TGP Generation – Effects of Waneta Upgrade Project." He noted that he had provided copies of this report to Mark Schneider. This was a two-part project, Ritchie said – first, we modeled gas entrainment over the spillways at Waneta; second, we took a brief look at what it would cost to modify the spillway at that project, and what the effects of that modification might be. Ritchie noted that the proposed letter of support for the Waneta expansion from the TGG would be greatly appreciated. Moving through his presentation, Ritchie touched on the following major topic areas:

- The geographic location and physical configuration of Waneta Dam
- The size of the proposed upgrade at Brilliant Dam (120 aMW, rather than the originally-proposed 100 aMW).
- The environmental benefits and potential negative impacts of the Waneta expansion
- The upgrade project itself – units 1 and 2 to be upgraded from a total powerhouse capacity of 26.2 Kcfs to 29.8 Kcfs.
- The study outline and methodology used to predict TGP levels and days of exceedance over a nine-year period of record.
- Conclusions: some reduction in TGP at the Canada/U.S. border can be attributed to the Waneta Upgrade Project; overall, the Brilliant Expansion Project has a greater predicted effect on TGP levels; there is limited further benefit attainable at Waneta from further spill reduction – either Waneta Expansion or physical spillway modifications.

Again, we appreciate the willingness of this group to support the Waneta Expansion Project, Ritchie said. He added that Cominco is looking at ways to provide monitoring information from the Waneta forebay to interested parties around the region, and invited those parties to contact Cominco directly. What levels of gas did you see below Waneta this year? Mike Schneider asked. There was no monitoring in the tailrace this year, primarily because that is a very difficult site to monitor accurately, Dana Schmidt replied. We hope to have a comprehensive monitoring system in place by next year, he added.

In response to a question from Ritchie, Schneider said it is his understanding that Ritchie will be contacting his home office to let the TGG know whether a letter in support of the 120 aMW Brilliant expansion project is necessary – there is some confusion on that point. Ritchie promised to do so later this morning.

The group devoted a few minutes of discussion to the need for a study that accurately evaluates what is happening, from a water quality standpoint, in the Waneta tailrace and at the border. We need to know where the gas is coming from, Carroll observed. Would Cominco be willing to co-fund such a study? one participant asked. I couldn't say, Ritchie replied – you

would need to take that up with Cominco.

D. Keenleyside. Schmidt led this presentation, noting that B.C. Hydro did not do any continuous monitoring below the Arrow Lakes generating station, which has just come on-line this year. The total capacity of this powerhouse is 185 aMW, or about 40 Kcfs. We did do some spot monitoring in the forebay and tailrace, he said, with the objective of determining whether TGP is formed as water passes through the turbines at this project, and to determine whether downstream TGP model predictions are accurate.

Schmidt shared some preliminary data from this monitoring effort, noting that field personnel in the Arrow Lakes tailrace saw a consistent 1% drop in the TGP levels coming in from the forebay. He noted that the plan is to re-run the model to compare its outputs against the actual values recorded. Our initial observation is that the model is pretty accurate, he said. Again, the group devoted a few minutes of discussion to the sometimes-anomalous TDG readings recorded at the U.S./Canada border.

2. Columbia and Snake River Mainstem Total Maximum Daily Loads, TDG and Water Temperature.

Mary Lou Soscia briefed the TGG on the current status of the Columbia/Snake River mainstem total maximum daily load (TMDL) process. She worked from a series of slides, touching on the following major project areas:

- The geographic scope of the mainstem TMDL.
- The Clean Water Act (CWA) requirements the TMDL is intended to satisfy
- What is a total maximum daily load? (the amount of pollutant a water body can receive and still meet water quality standards, the sum of allowable loads from point and nonpoint sources, considering seasonal variation and a margin of safety, allocates responsibility for reductions needed to achieve water quality standards)
- What is the technical process of a TMDL?
- What's happening on the Columbia/Snake River? (Columbia/Snake mainstem temperature TMDL, Lower Columbia River total dissolved gas TMDL, Lake Roosevelt/Mid-Columbia total dissolved gas TMDL, Snake River total dissolved gas TMDL)
- Other related activities
- Partnerships with state and tribal agencies
- Roles of key players (Oregon and Washington developing dissolved gas TMDL for Lower Columbia – completed September 2002; Washington developing dissolved gas TMDLs for Mid-Columbia and Lower Snake – due for completion June 2003; EPA taking the technical lead on temperature TMDL – due for completion June 2003; EPA developing dissolved gas TMDL for portions of tribal waters; EPA taking the lead in working with tribes)
- Columbia/Snake River 303 (d) listings for dissolved gas
- Columbia/Snake River 303 (d) listings for temperature
- The Lake Roosevelt TDG TMDL

- Highlights of the preliminary draft Columbia/Snake River temperature TMDL – temperature allocations (rivers divided into 21 reaches, each reach receives an allocation in terms of temperature increase over site potential; allocation represents the temperature increase allowed to result from human activities on the mainstems; reach allocations are based on the temperature increase caused by existing point sources and an additional 20 MW of heat energy for general NPDES permits and future growth; allocation for each dam in the reach; tributaries are allocated their existing loads)
- Highlights of the preliminary draft Columbia/Snake River temperature TMDL – effects of general users (dams are allowed essentially no increase over site potential; point sources with individual permits are allowed their existing discharges; point sources with general permits are allowed their existing discharges; some future growth is allowed via the group allocations; tributaries are allowed their existing loads; the majority of the non-point temperature impacts are via the tributaries; the tributaries may receive different load allocations when the tributary TMDLs are completed)
- Highlights of the preliminary draft Columbia/Snake River temperature TMDL – effects of the dams (dams that clearly increase temperature by more than a degree Centigrade: Grand Coulee, John Day, Lower Granite, Little Goose, Lower Monumental, Ice Harbor; dams with highly variable impacts up to a degree Centigrade: Chief Joseph, Wanapum; Dams with highly variable impacts from no impact to ½ a degree Centigrade: Wells, Rocky Reach, Rock Island, Priest Rapids, McNary, The Dalles, Bonneville)
- Preliminary draft Columbia/Snake temperature TMDL: next steps (draft TMDL, TMDL public comment period, final TMDL, state and tribal TMDL implementation plan, BiOp water quality plan, determine what can be done at dams to improve temperature, determine the costs, determine the benefits, make a decision to improve the dams or recognize that improvement is not possible and explore water quality standards changes)
- Preliminary draft Columbia/Snake temperature TMDL: public workshops – some comments received (how do you account for the effects of Canadian waters when dealing with Grand Coulee Dam? Does Grand Coulee have to correct for the Canadian contribution? How can the effects of Canadian projects be modeled? Have dam operators, both federal and PUDs, been involved in the TMDL process? Concerns about the FERC relicensing and 401 certification)
- Public involvement to date
- For more information – access the following websites: www.epa.gov/r10earth/index.htm, www.epa.gov/r10earth/columbiamainstemtmdl.htm, www.epa.gov/OWOW/tmdl/index.html.

Paul Pickett then provided further details about the mainstem dissolved gas TMDL.

I just spoke with Paul Freeman of Columbia Power about the letter of support from the TGG for the 120 MW Brilliant expansion, said Ritchie; he said he will ensure that Mark Schneider receive notification of the public consultation process coming up in November, when it would be appropriate for the TGG to express its support for this project.

3. Lake Roosevelt Limnology and Fate of TDG, Letter of Invitation from Lake Roosevelt Forum.

Last Monday, I received a letter from the Lake Roosevelt Forum inviting the Transboundary Gas Group to join them at the April 2003 conference, scheduled for April 21-23 in Spokane, said Mark Schneider. I discussed the invitation with the TGG steering committee, Schneider said, and our feeling is that we should schedule our meeting immediately after that conference, for April 23-24 in Spokane. It was so agreed.

With that, Schneider yielded the floor to Millar, who began the discussion by saying that, to him, Lake Roosevelt is a black hole, when it comes to dissolved gas. The Canadian Environmental Act of 1999 says Canada cannot pollute water going into the United States. To play devil's advocate, he said, can we look at Lake Roosevelt, do we understand where the river goes, and whether or not we can say Canadian gas is killing any fish in the United States?

Let's make the assumption that we're going to be able to meet with the Lake Roosevelt Forum and attend their conference, Mark Schneider said. In taking advantage of that opportunity, we will be able to make contact with people at the lake who have knowledge about specific issues, and help us answer some of the questions we have about the physical processes going on in Lake Roosevelt. With that in mind, said Schneider, I promised Andy Dunau that we would spend a few minutes this morning developing a list of technical questions about Lake Roosevelt.

A lengthy discussion ensued, ultimately yielding the following list of Lake Roosevelt questions:

- Where do GBD problems occur in Lake Roosevelt, when and under what flow/spill conditions?
- Where does the river go when it enters the lake?
- What is the dissolved gas profile in the lake?
- What Lake Roosevelt limnological data currently exists?
- What different contributions does Lake Roosevelt receive from the various Canadian and U.S. dams upstream?
- Where is the dissolved gas in the lake, and where are the fish in relation to that gas?
- What Lake Roosevelt water quality modeling tools exist, and are they adequate? Is anyone doing limnological modeling of the Lake Roosevelt system?
- Has anyone used regression analysis to look for a correlation between incoming TGP and TGP in the Grand Coulee forebay?
- What is the effect of TDG and temperature on the oxidized forms of toxic heavy metals in Lake Roosevelt?
- Due to changes in glacial melt, base flows in the Columbia River have been declining over the past 20 years. Should that be taken into account in the water temperature TMDL?
- What are the implications of various river management schemes for Lake Roosevelt?
- What opportunity does the Lake Roosevelt TMDL process have to help characterize that system limnologically?
- Have the tribes' cultural concerns been addressed in the Lake Roosevelt TMDL?

- What model does EPA intend to use to model water temperature in Lake Roosevelt?

Chris Maynard spoke to the idea of co-funding a study of inflow to Lake Roosevelt – how do we follow up that action item? he asked. There may be an opportunity for the State of Washington, EPA or both to help fund that study, he said. We will look to assign those action items when we send out the notes for this meeting, Millar replied.

4. Next TGG Meeting Date and Location.

The next meeting of the Transboundary Gas Group was set for April 23-24 in Spokane, Washington. Meeting summary prepared by Jeff Kuechle, BPA contractor.